no differences in summer gains for those previously implanted with 24 milligrams of stilbestrol and those not previously implanted. Total gains from the beginning of the winter until the end of the summer were greatest for those previously implanted with 24 milligrams of stilbestrol. The total gains of the other two groups were nearly equal.

The response, therefore, was variable and an additional test is being conducted.

Summary

Steer calves grazing dry range grass did not efficiently utilize urea-containing proteins supplements. Those fed pelleted cottonseed meal gained 14 pounds, while those fed a urea-containing pellet without addition of trace minerals or dehydrated alfalfa meal lost 34 pounds. Additions of several trace minerals, four trace minerals, and dehydrated alfalfa meal reduced the losses to 5, 10, and 10 pounds, respectively.

Winter gains of steer calves implanted with none, 12 milligrams, and 24 milligrams of stilbestrol were minus 16, minus 8, and 3 pounds, respectively. Steers which were implanted with none, 12 milligrams, and 24 milligrams of stilbestrol during the winter of 1957-58 gained 8, 20, and 32 pounds, respectively.

When the steers were allowed to graze native grass pasture during the subsequent summer as yearlings, the summer gains were 258, 244, and 256 pounds, respectively. Therefore, the greatest total gain (winter plus summer) was for those previously implanted with 24 milligrams of stilbestrol, with the total gains of the other two groups nearly equal.

Effects of Feeding or Injecting Certain Tranquilizers on Beef Cattle Performance, and Residues in the Carcass*

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The wide interest in tranquilizers as related to meat production has stimulated more detailed investigations of their effect on weaning calves, feed lot performance, and slaughter animals. It was considered also important to learn if this type compound will remain as residues in the edible tissues of the animal body.

*The studies on chlorpromazine, compazine, and SKF5354A were supported in part by a grant-in-aid from Smith, Kline, and French Laboratories. Philadelphia, Pa. Jensen-Salsbery Laboratories, Kansas City, Missouri, supplied the Diquel tranquilizer used.

The studies reported here were conducted under separate conditions at the Fort Reno Station, Lake Blackwell Range, and the OSU Meat Laboratory at Stillwater. The findings have been condensed into one article for this report. Part I pertains to the behavioral effects of Chlorpromazine, Part II reports the use of two compounds in weaning calves, Part III presents the use of compazine in fattening yearling steers, and Part IV pertains to the residual components of the edible tissues.

Part I. Effects of Chlorpromazine on Behavior

The observed physical effects of intravenous injections of Chlorpromazine were seen within a few minutes after injection. When a dosage of 0.4 milligram per pound of body weight was used, the calves appeared relaxed, but alert. Some incoordination of the legs was apparent when the animals moved. The fetlock joint would fail to straighten and the calves would move along on the front of their hoofs rather than the bottom. The rear legs had a tendency to drag.

The visible effects of the compound were usually apparent for four hours after injection. One animal showed signs of tranquilization after eight hours; however, no tranquility was seen after 72 hours.

There was a wide variation between animals in the degree of tranquilization obtained from a given dose. This was observed when some animals were tranquil after receiving 0.25 or 0.4 milligram per pound of body weight, while calves of the same age and weight were only slightly tranquilized after receiving 0.8 milligram per pound. Both injections were given intravenously. The more aggressive calves required a larger dose to produce tranquilization. This would indicate a problem in establishing dosages in the practical use of this drug.

Part II. Use of Tranquilizers in Weaning Calves

It has been suggested that tranquilizers are effective during periods of increased stress, such as at weaning. At this time there may also be an abrupt change of feed or other disturbances. There are many tranquilizers available with claims that they will reduce activity at weaning as well as shrinkage and disease during the post-weaning period. The effect on subsequent gains is not definitely known. In order to provide more information relating to this subject, three trials were conducted with calves at weaning.

Trial 1. Fort Reno—Procedure and Results

In Trial 1, 35 heifer calves at Fort Reno were divided into 3 lots after weighing at weaning. Lot 1 served as the control calves. Those in Lot 2 were injected intramuscularly in the rump with 0.9 milligram Diquel per pound of body weight immediately after weighing. The Lot 3 calves were injected with 0.3 to 0.35 milligram per pound of SKF5354A, a phenothiazine derivative, presently undergoing clinical

trials as a tranquilizer. Each group of calves was placed in a separate pen for 5 days. Weights were taken at weaning, and at 5 and 21 days after weaning. Observations relating to tranquility were recorded.

Weight gains are given in Table 1. There were practically no differences in weight among the three groups of calves. Approximately one-half of the injected calves demonstrated clinical tranquilization for about 48 hours. This was indicated by less bawling, by their reluctance to move and general depression, and by showing greater inclination to eat. No tranquility was detected in the remainder of the injected calves.

There was greater tranquilization with no undesirable side reactions from a dosage of 0.9 milligram of Diquel per pound of body weight than when a smaller dosage (0.7 milligram per pound of body weight) was injected (Trial 2). The drug had little, if any, effect on weight gains of calves at weaning.

TABLE 1. The effect of tranquilizer injections at weaning on subsequent weight changes of weaning calves.

	Lot 1 Control	Lot 2 Diquel[1]	Lot 3 SKF5354A[2]
Fort Reno (Trial 1)[3]			
Number of calves	11	13	11
Average gain per calf (lbs.)			
5 days, Oct. 10-15	— 5	— 5	2
21 days, Oct. 10-31	4	7	9
Lake Blackwell (Trial 2)[4]			
Number of calves	9	9	9
Average gain per calf (lbs.)			
2 days, Oct. 4-6	—17	—22	—20
6 days, Oct. 4-10	—32	—33	—29
19 days, Oct. 4-23	0	1	3
33 days, Oct. 4-Nov. 6	9	3	2
Lake Blackwell (Trial 3)[5]			
Number of calves	11	12	
Average gain per calf (lbs.)			
3 days, Oct. 11-14	—24	— 2	
6 days, Oct. 11-17	—13	0	
12 days, Oct. 11-23	2	9	
26 days, Oct. 11-Nov. 6	12	15	

[1] Ethyl isobutrazine manufactured by Jensen-Salsbery Laboratories, Inc., Kansas City, Missouri, and sold as Diquel. Injected intramuscularly into the rump at the rate of 1 mg. per lb. of body weight in Trials 1 and 3 and approximatly 0.7 mg. per lb. of body weight in Trial 2.

[2] A phenothiazine compound produced by Smith, Kline, and French Laboratories, Philadelphia, Pa. Injected intramuscularly at a dosage of 0.3 to 0.35 mg. per lb. of body weight.

[3] These were all heifer calves which weighed an average of 374 lbs. They were weaned on the day of treatment and each group was kept separate for 5 days following weaning.

[4] Five steers and four heifers per lot. All groups were placed together at weaning.

[5] Six steers and five heifers in Lot 1 and seven steers and five heifers in Lot 2. Control calves and injected calves were kept in separate pens during weaning. Due to an error the calves in Lot 2 were given more feed than the calves in Lot 1 for the 3-day period following weaning. The supplemental feed intake was equal for the remainder of the test.

Trial 2. Lake Blackwell—Procedure and Results

The procedure was as described in Trial 1 except that the Diquel dosage for the calves was approximately 0.7 milligram per pound of body weight rather than 0.9 per pound. The clinical tranquilization was less at the smaller dosage.

All calves were weighed at weaning and placed together in the same pen. They were weighed three additional times and the weight changes are recorded in Table 1. The weight changes of all cattle were essentially the same with no advantage for the tranquilizer-injected calves.

Trial 3. Lake Blackwell—Procedure and Results

Two groups of calves were used in Trial 3. The tranquilizer, Diquel, was injected intramuscularly at a dosage of 1 milligram per pound of body weight. The control calves and the injected calves were kept in separate pens at weaning. During the weaning period, both groups of calves were fed prairie hay and a supplemental protein feed.

The injected calves were given more supplemental feed during the three days following weaning than the control lot. Therefore, the weight changes during the 3-day period may be related to this fact. The weight loss of the control calves was slightly great for the first three days. However, in the subsequent periods, the difference became less and both groups weighed essentially the same at the end of the test.

In all three tests, the calves were weaned on the ranch where they were produced. None of the calves were shipped and there were no adverse conditions other than being separated from their dams. Since the excitement and stress were not great, the advantages from the tranquilizer injections may have been minimized.

Part III. Effect of Low Levels of Tranquilizer On Performance of Fattening Yearling Steers

Several tranquilizers have been reported to produce marked sedation in cattle when given intravenously, intramuscularly, or in the feed in large doses. The effect of low levels of tranquilizers in the ration of fattening cattle has received considerable attention. Preliminary results at this station on the use of two tranquilizers for fattening cattle have been obtained at levels much lower than those necessary to obtain sedation.

A number of other tranquilizers are now available or under test at various experiment stations. This report covers a limited feeding trial with a new tranquilizer (prochloperazine) carrying the trade name of Compazine.

Procedure

Fifteen long-yearling steers were purchased in May from the Oklahoma City Yards. These cattle had been on winter pasture and were in moderate flesh. They were brought to the Fort Reno Station and group fed the basal ration that was used in the trial for ten days.

Prior to obtaining an initial weight, they were shrunk (off feed and water for sixteen hours), and were allotted on the basis of their initial weight and grade into three lots, with the lots assigned to treatment at random. The cattle were fed individually, which permitted five replications for each treatment.

The ration consisted of 49.7 percent ground milo, 7.7 percent cottonseed meal, 7.6 percent molasses, 17.5 percent chopped alfalfa, and 17.5 percent ground ear corn. All steers were self-fed. A mixture of two parts salt and one part bone meal was offered free choice.

Lot 1 received the basal ration, Lot 2 received the basal ration plus 10 milligrams of tranquilizer (Compazine) per head per day, and Lot 3 received the basal plus 50 milligrams of tranquilizer. The average daily consumption per animal was calculated and the tranquilizer was mixed into each ration in a cottonseed meal premix for Lot 2 and 3 steers to obtain the desired levels of intake.

At the end of 129 days on test, a shrunk weight (sixteen hours off feed and water) was obtained. The steers were sold on a local market and dressing percentage and USDA grades were obtained.

Result and Discussion

The results at the end of 129 days on test failed to show an increase in rate of gain or feed efficiency from the two levels of Compazine fed (Table 2). There was a tendency for the cattle receiving the additive to sort the whole grain out of their feed in preference to the fine mix.

One steer on the 10 milligram level and another on the 50 milligram level did not eat well during the trial when compared to the other steers. These steers were of a nervous disposition throughout the trial and may have been affected by the pens in which they were confined. There was no evidence of ill health at slaughter, nor any significant amount of internal parasitism in any of the cattle. When these steers are not considered, average daily gains become 2.50 and 2.48 pounds per head for Lots 2 and 3, respectively.

Part IV. Metabolism of Chlorpromazine and Its Residual Aspects

The studies at the OSU Meat Laboratory were based upon the use of chlorpromazine hydrochloride, one of the many tranquilizers on the market. This tranquilizer solution was injected into the blood stream of all the treated animals. In one instance, intramuscular injections were also made.

TABLE 2. Effect of feeding the tranquilizer, compazine, at two levels in steer fattening rations.

Treatment	Lot 1 Control	Lot 2 10 mg. level	Lot 3 50 mg. level
No. of steers per lot	5	5	5
Average weights (lb.)			
Initial 5/29/58	757	762	751
Final 10/6/58	1112	1102.5	1072.5
Total gain (lb.)	355	291	286
Average daily gain (lb.)	2.75	2.26	2.22
Average daily ration (lb.)	30.7	27.4	26.6
Feed per cwt. gain (lb.)	1116	1212	1198
Dressing percentage	60.3	60.6	60.1
Carcass grade score[1]	17.4	18.6	17.8

[1] Carcass grades were scored as follows: Choice=20, Good=17.

Procedure

Preliminary studies, along with a survey of previous work and recommendations of veterinarians, indicated that 0.4 milligram of chlorpromazine per pound of live body weight was a satisfactory dosage for this drug. These same preliminary studies indicated that between 10 to 15 percent of the chlorpromazine injected was excreted in the urine as chlorpromazine or chlorpromazine sulfoxide, the main metabolite, within 10 to 24 hours after injection. These figures are in agreement with other studies using several species of small animals.

Six Hereford calves, weighing from 275 to 360 pounds were used in an effort to determine what happens to the chlorpromazine after it enters the body of the beef animal . These calves were slaughtered and samples of the various tissues were removed and immediately frozen until they could be analyzed for chlorpromazine and chlorpromazine sulfoxide. The tissues which were sampled included: muscle, fat, brain, spleen, lung, kidney, liver, heart, blood, and tongue.

The analysis was completed using a procedure outlined by Salzman and Brodie and a modified procedure developed in the Smith, Kline, and French Laboratory by Flanagan and associates.

Results and Discussion—Residuals

Three calves (Animals 1, 2, and 3 in Table 3) were injected intravenously with 0.4 milligram per pound of chlorpromazine hydrochloride and slaughtered at 4, 8, and 72 hours after injection.

As the data indicate, a small amount of chlorpromazine was detected in the fat of Calf Number 1, slaughtered after four hours. Several tissues from Calf Number 2, slaughtered eight hours after injection, contained residues. Chlorpromazine sulfoxide was also found in the kidney of

this calf. Animal Number 3, slaughtered seventy-two hours after injection, had no detectable residues in the tissues examined.

Animal Number 4, as shown in Table 3, was injected with 0.4 milligram per pound of chlorpromazine. After a 2½ hour period, it was injected again with a similar dose, making the total injection 0.8 milligram per pound. This calf was slaughtered four hours after receiving the last injection. The increased dose resulted in some concentration in the tissues and increased the number of tissues which contained detectable residues of chlorpromazine.

The fifth calf used in this study was injected intravenously with 0.8 milligram per pound of chlorpromazine. For three days following this initial injection, the calf was maintained in a tranquilized state by additional intramuscular injections of chlorpromazine. Four intramuscular injections of 2 milligrams per pound each were given during the three day period.

The calf was slaughtered and the muscles of the chuck area were observed for evidence of physical damage due to injections. Areas of necrotic or eroded tissue were found at the injection sites. Tissue samples were removed and frozen as before. The lean tissue of the chuck area was removed, ground, and mixed thoroughly immediately following the slaughter. The ground meat was placed in the cooler and samples were removed at various intervals for analysis. This was

TABLE 3. Residue, quantity injected, slaughter time, and extent of tranquilization.

Animal No.	1	2	3	4
Chlorpromazine injected mg./lb.	0.4	0.4	0.4	0.8
Slaughtered after injection (hours)	4	8	72	4
Tranquilization[1] after injection	xxxx	xx	xx	xxx
at slaughter	xx	0	0	xxx
Residues (mg/100 g. tissue) Chlorpromazine	Fat	Heart 0.09	____	Fat 0.17
		Lung 0.10		Liver 0.07
		Brain 0.05		Heart 0.06
		Tongue 0.06		Lung 0.18
				Brain 0.15
				Spleen 0.17
				Blood 00.06
Chlorpromazine sulfoxide	_____	Kidney 0.08	____	_____

[1] 0—no visual tranquilization
x—slight tranquilization
xxxx—extreme tranquilization

done in an attempt to determine metabolism of the tranquilizer in the tissue after slaughter and during the aging process.

From this limited data it appears unlikely that any metabolism of chlorpromazine occurs in beef muscle during chilling and aging. Chlorpromazine residuals were detected in the lung and kidneys of Animal Number 5.

The sixth calf was used as a control. It was handled in the same manner as the others but received no tranquilizer. Samples of the tissue were removed and frozen following slaughter and were analyzed with samples from treated calves.

The residuals, as determined in this study, do not approach the amounts injected, therefore we cannot account for the rest of the chlorpromazine after it enters the animal's body. The new Food and Drug Law requires that all of a material introduced into a meat animal prior to slaughter must be accounted for. Until better methods of analysis become available, it is doubtful that this can be done with chlorpromazine. Even then it is quite possible that the total dose will not be accounted for.

Even though there was no chlorpromazine found in the muscle itself, the residuals were so widely distributed throughout other tissues, some of them edible, that it is unlikely that meat from such animals would be approved for human consumption.

Summary

There was a wide variation between animals in the degree of tranquilization obtained from a given dose. A practical dose may be adequate to make one animal docile, while another animal of equal age and weight may show very little evidence of sedation.

When weaning calves were given intramuscular injections of Diquel or SKF5354A only about one-half of the injected calves demonstrated clinical tranquilization, and this lasted less than 48 hours. A dosage of 0.9 to 1 milligram of Diquel per pound of body weight resulted in greater tranquilization than a dosage of 0.7 milligram per pound. There was no relationship, however, between the tranquilizer injected and weight gains of calves at weaning or the 21 to 33 day period following weaning.

The addition of Compazine to the feed of yearling steers did not improve the rate of gain, feed efficiency, or carcass merit of the animal used in these trials.

Small quantities of residual chlorpromazine were found in the fat, brain, heart, lung, and kidney of beef animals injected with the drug. Animals held for 72 hours after injection had no residual compound in any of the tissues. The lean muscle contained no residue regardless of the dose level.

From the results of these experiments, it is questionable whether tranquilizers have as much potential for increasing profits in meat animals as one would gather from advertisements. Undoubtedly tranquilizers are of great value in selected situations. More studies are needed before such situations can be precisely defined.

Effect of Stilbestrol Implants on Summer Gains And Subsequent Feedlot Performance of Yearling Steers

A. B. Nelson, L. S. Pope, and D. F. Stephens

Stilbestrol has been widely used as a means of increasing gains of fattening beef cattle. Experiments have indicated a smaller response from implanting or feeding stilbestrol to cattle on wintering rations. The response obtained on summer pasture is apparently related to grazing conditions. In areas of the country where legumes and legume-grass mixtures predominate, stilbestrol implantation has resulted in marked increases in gain.

In Oklahoma, most steers graze native grass pastures during the summer with no supplemental feed except minerals. Under these conditions, the preferred method of stilbestrol administration would be implants. Apparently one implant will last for the entire grazing season. When high levels of stilbestrol are implanted, certain side effects such as elevated tail-heads, flat loins, and increased teat length are sometimes observed. An important question is whether or not low level implants are effective in increasing weight gains.

Cattle feeders have questioned the practice of implanting steers during the grazing season since they believe that subsequent performance in the feed-lot will be affected. Many feeder buyers believe that there should be some price discrimination against implanted cattle since these cattle may not perform as well in the feed-lot or respond as well to further stilbestrol treatment as those not previously implanted. This is a problem of considerable economic importance.

In order to obtain more data on this problem, the feedlot performance of control and implanted yearling cattle used in a summer grazing test was observed in a subsequent fattening trial. Elsewhere in this publication is an article dealing with the subsequent performance of previously implanted suckling calves which indicates no apparent adverse effects when fed fattening rations or under wintering conditions.